

CLAIMS

1. An alignment system for a lithographic apparatus, comprising:
a radiation sensor arranged in a path of at least a portion of a beam of alignment radiation, including:
a radiation-sensitive material which converts said alignment radiation into
secondary radiation; and
a detector constructed and arranged to detect said secondary radiation emerging from said radiation-sensitive material,
wherein an output signal from said detector is used to determine an alignment condition of an alignment mark.
2. An alignment system for a lithographic apparatus according to claim 1, wherein said radiation-sensitive material converts said beam of alignment radiation from a wavelength λ_1 into electromagnetic radiation having a wavelength λ_2 that is larger than wavelength λ_1 .
3. An alignment system for a lithographic apparatus according to claim 2, wherein said wavelength λ_1 is smaller than 50 nm.
4. An alignment system for a lithographic apparatus according to claim 1, wherein said radiation-sensitive material comprises a compound selected from the group comprising: CaS:Ce, YAG:Ce, ZnS:Ag,Al.
5. An alignment system for a lithographic apparatus according to claim 1, wherein said alignment system is configured to align said alignment mark on said substrate with an alignment mark on a mask held by a mask holder.
6. An alignment system for a lithographic apparatus according to claim 1, further comprising:
a position monitoring unit; and

a position controller,
wherein said position monitoring unit and said radiation sensor are useable by said position controller to control a stage position.

7. An alignment system for a lithographic apparatus according to claim 6, wherein said position monitoring unit comprises an interferometer.

8. An alignment system for a lithographic apparatus according to claim 1, wherein at least part of said radiation sensor is carried by a substrate holder.

9. An alignment system for a lithographic apparatus according to claim 1, wherein said radiation-sensitive material converts said alignment radiation into electrons freed from said radiation-sensitive material.

10. An alignment system for a lithographic apparatus according to claim 9, wherein said detector comprises a measuring device electrically connected to said radiation-sensitive material so as to measure an electrical current induced by further electrons replacing said freed electrons.

11. An alignment system for a lithographic apparatus according to claim 10, wherein said detector further comprises a collector and said collector is configured to collect said electrons freed from said radiation-sensitive material.

12. An alignment system for a lithographic apparatus according to claim 11, wherein said collector is positively charged with respect to said radiation-sensitive material so as to attract said freed electrons.

13. An alignment system for a lithographic apparatus according to claim 12, wherein an electrical field strength between said radiation-sensitive material and said collector is selected such that said electric field overcomes space charge effects.

14. An alignment system for a lithographic apparatus according to claim 13, wherein said electrical field strength is larger than 50 V/cm.

15. An alignment system for a lithographic apparatus according to claim 9, wherein said detector comprises:

a collector to collect said electrons freed from said radiation-sensitive material, and

a measuring device connected to said collector configured and arranged to measure an electrical current induced by said collected electrons.

16. An alignment system for a lithographic apparatus according to claim 9, wherein said radiation-sensitive material is arranged in an array of individual elements and said detector is arranged so as to separately detect electrons freed from said individual elements.

17. An alignment system for a lithographic apparatus according to claim 16, wherein said individual elements are arranged as an array of lines.

18. An alignment system for a lithographic apparatus according to claim 1, wherein said radiation-sensitive material comprises at least a portion of a substrate having said alignment mark.

19. A radiation sensor for detecting radiation in a lithographic apparatus, comprising:

a radiation-sensitive material configured to convert a primary radiation into secondary radiation; and

a detector constructed and arranged to detect said secondary radiation emerging from said radiation-sensitive material,

wherein intensity of said secondary radiation is used to determine intensity of said primary radiation and said radiation sensor is operatively connected with at least one subsystem of said lithographic apparatus.

20. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 19,

wherein said subsystem includes at least one of a projection system, an alignment system and a transmission image sensor.

21. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 19, wherein said radiation-sensitive material converts said primary radiation from wavelength λ_1 into secondary radiation having a wavelength λ_2 that is larger than wavelength λ_1 .

22. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 19, wherein said primary radiation said wavelength λ_1 is smaller than 50 nm.

23. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 19, wherein said radiation-sensitive material comprises a compound selected from the group comprising: CaS:Ce, YAG:Ce, ZnS:Ag,Al.

24. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 19, wherein said radiation-sensitive material converts said primary radiation into electrons freed from said radiation-sensitive material.

25. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 24, wherein said detector comprises a measuring device electrically connected to said radiation-sensitive material so as to measure an electrical current induced by further electrons replacing said freed electrons.

26. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 25, wherein said detector further comprises a collector and said collector is configured to collect said electrons freed from said radiation-sensitive material.

27. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 26, wherein said collector is positively charged with respect to said radiation-sensitive material so as to attract said freed electrons.

28. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 27, wherein an electrical field strength between said radiation-sensitive material and said collector is selected such that said electric field overcomes space charge effects.

29. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 28, wherein said electrical field strength is larger than 50 V/cm.

30. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 26, wherein said detector comprises:

a collector to collect said electrons freed from said radiation-sensitive material, and

a measuring device connected to said collector configured and arranged to measure an electrical current induced by said collected electrons.

31. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 26, wherein said radiation-sensitive material is arranged in an array of individual elements and said detector is arranged so as to separately detect electrons freed from said individual elements.

32. A radiation sensor for detecting radiation in a lithographic apparatus according to claim 31, wherein said individual elements are arranged as an array of lines.